EVALUATING SEDIMENTS USING TOXICITY IDENTIFICATION EVALUATION (TIE) TECHNOLOGY

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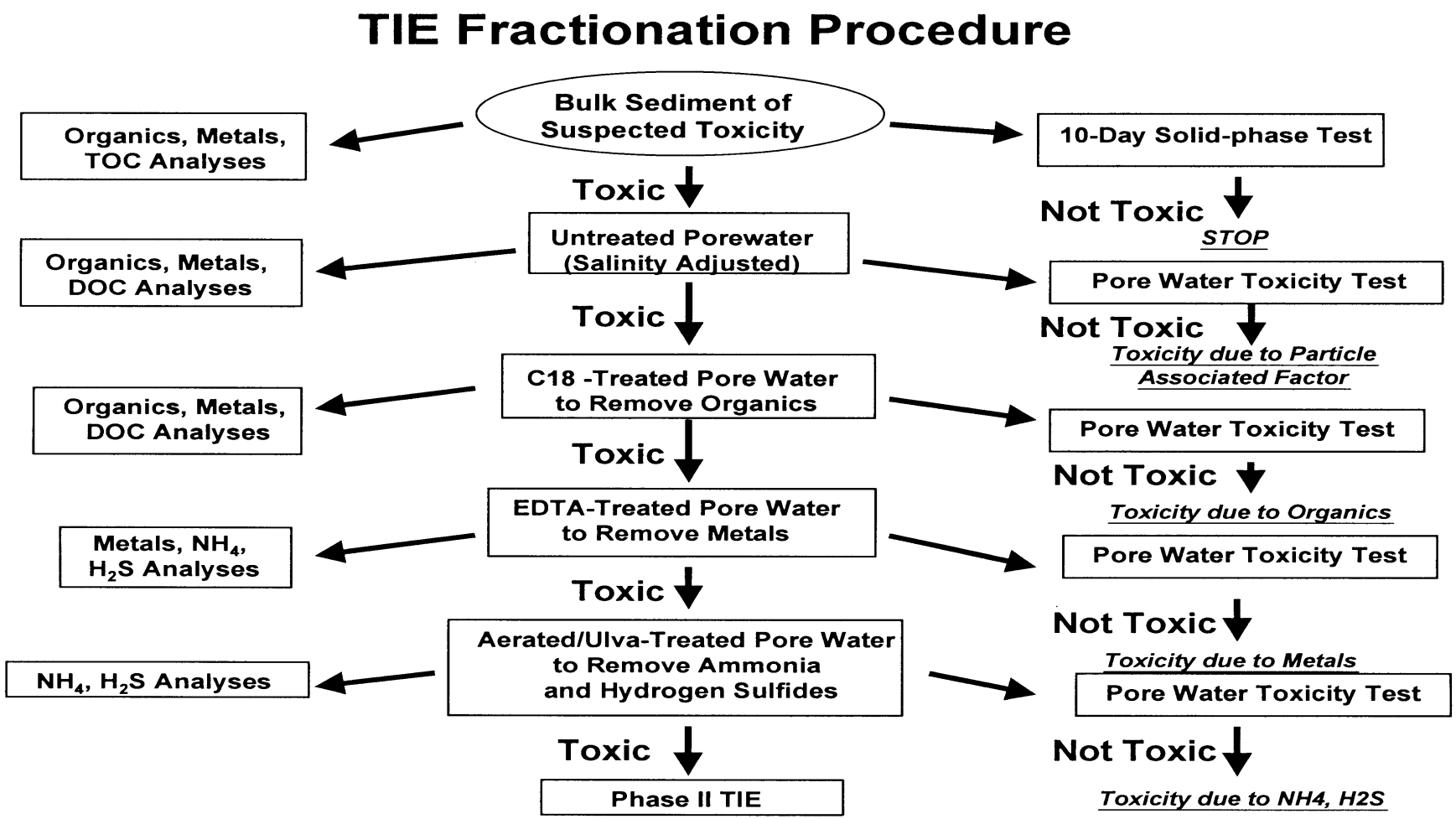
NORTHDIV

Technology Description

- ***Description*: A series of lab tests that manipulates physical/chemical properties of sediment pore water to bind classes of chemicals and certain confounding factors thus rendering them biologically unavailable**
- **NORTHDIV utilized an approach designed by SAIC that improved upon current EPA methodology**
  - **Test ran in series rather than parallel**
  - **Improved data format**
    - **Results easier to interpret**
    - **More understandable data reporting**
  - **Designed to be integrated into the RI/FS process**

Figure 2.4-1. Toxicity Identification Evaluation porewater chemical fractionation procedure.



When to Utilize TIE?

- Preliminary Ideal Data Needs
  - Previously demonstrated sediment toxicity data
  - Sediment chemistry data that indicates sediment toxicity may occur when compared to benchmarks
- Other useful data
  - AVS/SEM
  - Total Organic Carbon (TOC)
  - Grain size

Why Utilize TIE?

- Provides evidence as to which CoCs are causing risk
- Identifies whether confounding factors (e.g. ammonia) could be contributing to a portion or all of the toxicity
- Helps develop better conclusions for an ERA and site-specific cleanup goals if remediation is determined necessary

Goss Cove Background

- Formerly a portion of the Thames River, isolated by construction of railroad bed;
- Western portion of cove used as landfill between 1946 - 1957;
- Remaining cove sediments low in oxygen;
- Chemicals in cove sediment (PCBs, metals, pesticides) at levels of potential concern;
- Preliminary investigation found toxicity and concluded risks to aquatic biota did exist.

TIE Used to Investigate Toxicity

- TIE showed that toxicity due to ammonia (confounding factor) and not site related CoCs
- No Further Action Finding proposed and accepted by regulators
- Avoided Navy $2M in potential sediment remediation

Utilizing TIE Goss Cove Results to Reach Conclusions

Leptocheirus plumulosus

	Porewater EC50 (% of control)							
	Untreated		C18 Treated		EDTA Treated		Ulva Treated	
Station	EC50	Flag[a]	EC50	Flag[a]	EC50	Flag[a]	EC50	Flag[a]
GC-1	100	-	100	-	100	-	100	-
GC-2	100	-	100	-	100	-	100	-
GC-3	100	-	100	-	100	-	100	-
GC-4	100	-	100	-	100	-	100	-
GC-5	100	-	75.0	+	81.0	+	100	-
GC-6	100	-	100	-	100	-	100	-
GC-7	100	-	100	-	100	-	100	-
GC-8	100	-	70.0	+	100	-	100	-
GC-9	100	-	100	-	100	-	100	-
GC-10	100	-	100	-	100	-	100	-

Menidia beryllina

	Porewater EC50 (% of control)							
	Untreated		C18 Treated		EDTA Treated		Ulva Treated	
Station		Flag[a]		Flag[a]		Flag[a]		Flag[a]
GC-1	86.0	+	69.0	++	71.0	+	100	-
GC-2	69.0	++	74.0	+	64.0	++	100	-
GC-3	75.0	+	64.0	++	64.0	++	100	-
GC-4	74.0	+	64.0	++	69.0	++	100	-
GC-5	37.0	+++	43.0	+++	50.0	++	85.0	+
GC-6	90.0	+	75.0	+	60.0	++	100	-
GC-7	64.0	++	67.0	++	64.0	++	100	-
GC-8	100	-	83.0	+	100	-	100	-
GC-9	100	-	67.0	++	100	-	100	-
GC-10	100	-	90.0	+	100	-	100	-

a-Rankings for impacts to *Leptocheirus* and *Menidia* survival:
High (+++) < 50%; Interm ediate (++) ≥ 50% and < 70%;
Low (+) ≥ 70% and <100%; and Non-toxic (-) ≥ 100%

YO817 TIE Demonstration

- Northdiv and SAIC submitted proposal for improved TIE application to the Alternative Restoration Technologies (ART) workgroup for review
- TIE selected by ART workgroup for YO817 funding and validation.

TIE Project Objectives

- **Demonstrate effectiveness of improved TIE procedure**
  - Navy sites with different sediment types
  - in different EPA regions
- **Evaluate state-of-the-art TIE extraction methods**
- **Develop "User's Guide"**
  - standardized TIE approach
  - data interpretation & presentation techniques
  - when and where to use TIE
  - cost and schedule information

Expected Benefits of Project

- Provide a proven tool for use at other Navy sediment sites
- Focus remedial action requirements
  - Support No Further Action (NFA) decisions when toxicity is related to confounding factors
  - Aide in focusing or confirming those COCs that require cleanup goals

TIE Demonstration Sites

- NSWC Indian Head
  - Past bulk sediment tests illustrated toxicity in sediment in unnamed stream adjacent to Site 42
  - Additional TIE samples taken in Mattawoman Creek adjacent to Sites 39 &41.
- Second site will most likely be in EPA Region IX

Utilizing TIE at Your Site

- Carefully evaluate whether a TIE could provide an added benefit at your sediment site
  - What does your past chemistry data show?
  - Is past toxicity uncertain?
  - Are CoCs mainly bioaccumulative in nature?
  - Time and Cost considerations
- User's guide should help in this evaluation (Draft Fall 01)

Accessing the Technology

- A Broad Agency Announcement (BAA) contract with SAIC for the YO817 TIE Project has been setup through NFESC
  - Allows future potential users to access the technology quickly if needed
- POC at NFESC is Ruth Owens

Conclusions

- Provides evidence as to which CoCs are causing risk
- Identifies whether confounding factors (e.g. ammonia) could be contributing to a portion or all of the toxicity
- Helps develop better conclusions for an ERA and site-specific cleanup goals if remediation is determined necessary

Points of Contact

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